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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/797,046

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Jung-hyun Lee

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EXAMINER

NADAV, ORI

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/797,046	Applicant(s) LEE ET AL.	
	Examiner Ori Nadav	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 November 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 22 and 23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22 and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (6,844,604) in view of Chang et al. (3,996,021) and Seidl et al. (2002/0014647).

Lee et al. teach in figure 1 and related text a capacitor of a semiconductor device (column 2, lines 66-67), the capacitor comprising:

- a lower electrode (see column 1, line 48 and column 3, line 59);

- an $\text{AlO}(\text{Al}_x\text{O}_y)$ film 14 formed on the lower electrode;

- an upper electrode formed on the AIO film; and

- a dielectric film 14 having a dielectric constant that is higher than that of the AIO film between the upper electrode and the AIO film,

- wherein the dielectric film is an HfO_2 layer, a ZrO_2 , or an STO layer (column 2, lines 66-67), and

- wherein the dielectric film is directly in contact with the upper electrode (since the first layer is an HfO_2 dielectric film, see column 2, lines 66-67).

Lee et al. do not teach using an $\text{AlO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film.

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Chang et al. teach using an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film instead of AIO film (column 6, lines 33-50).

Seidl et al. teach in figure 1n and related text a capacitor comprising a lower electrode 60, an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film 70 formed on the lower electrode, and an upper electrode 80 formed in direct contact with the AHO film.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to replace the AIO film in Lee et al.'s device with an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film in order to improve the device characteristics.

The combination is motivated by the teachings of Chang et al. who point out the advantages of using an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film instead of AIO film (column 6, lines 33-50).

Note that substitution of materials is not patentable even when the substitution is new and useful. *Safetran Systems Corp. v. Federal Sign & Signal Corp.* (DC NIII, 1981) 215 USPQ 979.

Regarding the claimed imitations of lower and upper electrodes, these features are inherent in Lee et al.'s device, because a capacitor must include lower and upper electrodes. Seidl et al. is also cited to teach a capacitor comprising a lower electrode and an upper electrode.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Conley Jr. et al. in view of Chang et al. (3,996,021) and Seidl et al. (2002/0014647).

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Conley, Jr. et al. teach in figure 5d and related text a capacitor of a semiconductor device, the capacitor comprising:

a lower electrode;

an $\text{AlO}(\text{Al}_x\text{O}_y)$ film 144 formed on the lower electrode;

an upper electrode formed on the AIO film; and

a dielectric film 143 having a dielectric constant that is higher than that of the AIO film between the upper electrode and the AIO layer,

wherein the dielectric film is an HfO_2 layer, a ZrO_2 , or an STO layer (abstract),
and

wherein the dielectric film is directly in contact with one electrode.

Conley, Jr. et al. do not teach using an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film, and do not explicitly state that the dielectric film is directly in contact with the upper electrode.

Chang et al. teach using an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film instead of AIO film (column 6, lines 33-50).

Seidl et al. teach in figure 1 and related text a capacitor comprising a lower electrode, an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film formed on the lower electrode, and an upper electrode formed in direct contact with the AHO film.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to replace the AIO film in Conley, Jr. et al.'s device with an $\text{AHO}((\text{Al}_x, \text{Hf}_{1-x})\text{O}_y)$ film and to form the dielectric film in direct contact with the upper electrode, in order to improve the device characteristics and in order to use the capacitor in an application which requires specific electrode positioning, respectively.

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The combination is motivated by the teachings of Chang et al. who point out the advantages of using an AHO($(\text{Al}_x\text{Hf}_{1-x})\text{O}_y$) film instead of AlO film (column 6, lines 33-50).

Note that substitution of materials is not patentable even when the substitution is new and useful. *Safetran Systems Corp. v. Federal Sign & Signal Corp.* (DC NIII, 1981) 215 USPQ 979.

Regarding the claimed imitations of lower and upper electrodes, these features are inherent in Conley, Jr. et al.'s device, because a capacitor must include lower and upper electrodes. Seidl et al. is also cited to teach a capacitor comprising a lower electrode and an upper electrode.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over (Lee et al. or Conley Jr. et al.) each in view of Chang et al. and Seidl et al., as applied to claim 22 above, and further in view of Chooi et al. (6,486,080).

(Lee et al., Yeo et al. or Conley Jr. et al.) and Chang et al. and Seidl et al. teach substantially the entire claimed structure, as applied to claim 22 above, except an oxidation barrier film formed between the lower electrode and the AHO layer.

Chooi et al. teach an oxidation barrier film formed between the lower electrode and the AHO layer (column 2, lines 16-20).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an oxidation barrier film formed between the lower electrode and the AHO layer in prior art's device, in order to improve the device characteristics, .

Response to Arguments

Applicant argues that Lee does not teach or suggest "the dielectric film is an HfO₂ layer, a ZrO₂ layer, or an STO layer, and wherein the dielectric Film is directly in contact with the upper electrode" as recited in independent claim 22, because "the first layer is indicated by reference number 18 and the second layer is indicated by reference number 20. As shown in Fig. 1B, the first and second layers 18 and 20 are sequentially stacked. Accordingly, the uppermost layer is the second layer 20, which is an AIO layer. Because an upper electrode would be formed on the second layer 20, Applicants submit that the upper electrode is always in contact with the second layer 20 or the AIO layer, rather than the dielectric film as recited in claim 22".

The examiner agrees that that it appears from the citation which applicant provided, that the first and second layers 18 and 20 are sequentially stacked, and the uppermost layer is the second layer 20, which is an AIO layer. However, in column 7, lines 23-24, Lee et al. states that layer 20 can comprise HfO₂. This statement means that the materials for the first and second layers 18 and 20 are interchangeable, and the second layer 20 can be an HfO₂ layer, and the first layer 18 can be the AIO layer. Therefore, Lee et al. teach the claimed limitation of "the dielectric film is an HfO₂ layer, a ZrO₂ layer, or an STO layer, and wherein the dielectric Film is directly in contact with the upper electrode" as recited in independent claim 22.

Applicant argues that "the first layer 18 of Lee is not an AHO film, but rather the first layer 18 is made of only HfO₂, ZrO₂, Ta₂O₃ or Y₂O₃, and therefore, does not

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disclose the AHO film of claim 22". Applicant further argues "the Examiner alleges that an element indicated by reference number 14 in Lee indicates both an A10 film formed on a lower electrode and a dielectric film between the upper electrode and the A10 film. However, the Examiner's allegation is incorrect because one element can't indicate two different elements as recited in claim 22".

The examiner agrees that the first layer 18 of Lee is not an AHO film, but rather the first layer 18 is made of only HfO_2 , ZrO_2 , Ta_2O_3 or Y_2O_3 , and therefore, does not disclose the AHO film of claim 22. However, layer 18 is not used in the rejection. Layer 14 is used in the rejection. Layer 14 refers to both the AIO film formed on a lower electrode and the dielectric film between the upper electrode and the AIO film, because layer 14 comprises layers 18 and 20. Therefore, layer 14 (one element structure) can indicate two different elements (layers 18 and 20), as recited in claim 22.

Applicant argues that the combination of Al and HfO disclosed in Chang is used to coat the outside surface of a metal article in order to improve resistance to high temperature environments (see abstract, col. 6, lines 41-44). Chang does not disclose using the combination of Al and HfO as a dielectric layer of a capacitor as in claim 22". Therefore, if Chang's Al and HfO layer is applied to Lee or Conley, Chang's layer would be only used to coat the surface of an article disclosed in Lee or Conley, not used to replace the second layer on which an upper electrode would be formed. "Accordingly, Applicants submit that one skilled in the art would not be motivated to replace the

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second layer of Lee [or Conley] with the layer disclosed in Chang in order to render obvious claim 22”.

Although Chang et al. use the composite material obtained by the combination of Al and HfO for coating applications, and not as a dielectric layer of a capacitor, the composite material is not applicable only to coating applications. Chang et al. teach that the composite material is more stable than AIO alone. Clearly, an artisan forming an AIO dielectric layer for a capacitor, would be motivated to replace the AIO material with the more stable composite material of Chang et al., in order to improve the capacitor characteristics. Note that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim.

Applicant argues that “the combination of Chang and Conley fails to disclose a dielectric film between an AHO film and an upper electrode and in direct contact with the upper electrode as recited in claim 22”, because uppermost layer of the dielectric layer structure disclosed in Conley is an AIO film. “Accordingly, even if it were possible to replace Conley's aluminum oxides 144 and 144' with Chang's AHO film (which Applicants do not admit), the AHO film would be in contact with an upper electrode formed on the dielectric layer structure”.

The examiner agrees that Conley, Jr. et al. do not explicitly state that the dielectric film is directly in contact with the upper electrode, because layer 144' is the

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most upper layer. However, the examiner asserts that it would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the dielectric film in direct contact with the upper electrode, in order to use the capacitor in an application which requires specific electrode positioning.

Note that the elements a “lower electrode” and an “upper electrode”, as recited in claim 22, are interchangeable, because the terms “lower” and “upper” depend on the direction from which the structure is viewed. A recitation of a base structure, such as a substrate, will explicitly define the “lower electrode” and the “upper electrode”.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne Gurley can be reached on 571-272-1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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